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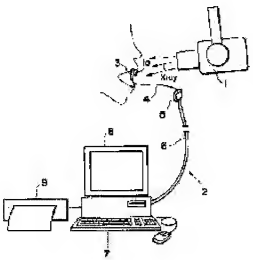
(54) DENTISTRY X-RAY IMAGE PICKUP DEVICE AND ITS MODULE

(57)Abstract:

PROBLEM TO BE SOLVED: To miniaturize a tooth image detecting part by setting a first cable connected with the tooth image detecting part and a second cable connected with an image pickup element control means and placing a image pickup time control part that has a trigger pulse generation circuit between those two cables.

SOLUTION: An X-ray radiation source 1 from which radiates X-ray and a tooth image detecting part 3 (sensor head) set on a top of image pickup device module 2 are opposed to be placed with putting a teeth 1a between them. The tooth image detecting part 3 is connected to the control box 5, which is an image pickup time control part, with the cable 4. The control box 5 is connected to the control unit 7 with the cable 6. The control box 5 has a trigger pulse generation circuit and a buffer circuit and it is formed to adjust the X-ray image pickup time automatically according to the irradiation time of X-ray radiation source. Thus it needs the arrangement of the trigger pulse generation circuit on the tooth image detecting part 3 and makes miniature.



Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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FULL CONTENTS

[Claim(s)]

[Claim 1] While being arranged on the scintillator which emits light by incidence of the penetration X-rays which penetrated the teeth which are a photographic subject, the solid-state image sensing device which picturizes the light emitted from said scintillator, the base board with which said solid-state image sensing device is arranged, and said base board The teeth image primary detecting element which has the photoelectrical element which produces photoelectric current when the light emitted from said scintillator enters, The imaging time control part which has the trigger pulse generating circuit which changes into a trigger pulse said photoelectric current outputted from said photoelectrical element, An image sensor control means to transmit the read-out signal for reading the integration time control signal which controls the imaging time of said solid-state image sensing device, and the electric signal accumulated in said solid-state image sensing device based on said trigger pulse to said solid-state image sensing device, While connecting a monitor means to display X line image of the teeth while connecting with said image sensor control means, and said teeth image primary detecting element and said imaging time control part Said electric signal accumulated in said solid-state image sensing device and said photoelectric current outputted from said photoelectrical element are transmitted to said imaging time control part from said teeth image primary detecting element. The first cable which transmits the aforementioned read-out signal for reading said integration time control signal which controls the imaging time of said solid-state image sensing device, and the electric signal accumulated in said solid-state image sensing device from said imaging time control part to said teeth image primary detecting element, While connecting said imaging time control part and said image sensor control means, said electric signal outputted from said solid-state image sensing device and said trigger pulse outputted from said imaging time control part are transmitted to said image sensor control means from said imaging time control part. X line image imaging device for dentistries characterized by having the second cable which transmits the aforementioned read-out signal for reading said electric signal accumulated in said solid-state image sensing device, and said integration time control signal which controls the imaging time of said solid-state image sensing device from said image sensor control means to said imaging time control part.

[Claim 2] X line image imaging device for dentistries according to claim 1 with which said second cable is characterized by being thicker than said first cable.

[Claim 3] X line image imaging device for dentistries according to claim 1 or 2 characterized by arranging

two of said photoelectrical elements on both sides of said solid-state image sensing device.
[Claim 4] While picturizing the scintillator which emits light by incidence of the penetration X-rays which penetrated the teeth which are a photographic subject, and the light emitted from said scintillator While being arranged on the solid-state image sensing device which outputs the electric signal accumulated by inputting a read-out signal from the exterior, the base board with which said solid-state image sensing device is arranged, and said base board The teeth image primary detecting element which has the photoelectrical element which produces photoelectric current when the light emitted from said scintillator enters, While connecting the imaging time control part which has the trigger pulse generating circuit which changes said photoelectric current outputted from said photoelectrical element into the trigger pulse which controls the imaging time of said solid-state image sensing device, and said teeth image primary detecting element and said imaging time control part Said electric signal accumulated in said solid-state image sensing device and said photoelectric current outputted from said photoelectrical element are transmitted to said imaging time control part from said teeth image primary detecting element. In order to control the imaging time of the aforementioned read-out signal based on said trigger pulse inputted from the outside in order to read said electric signal accumulated in said solid-state image sensing device, and said solid-state image sensing device The first cable which transmits the integration time control signal based on said trigger pulse inputted from the outside from said imaging time control part to said teeth image primary detecting element, While connecting with said imaging time control part, said electric signal outputted from said solid-state image sensing device and said trigger pulse outputted from said imaging time control part are transmitted outside from said imaging time control part. The module for X line image imaging devices for dentistries characterized by having the second cable which transmits the aforementioned read-out signal inputted from the outside, and said integration time control signal to said imaging time control part.
[Claim 5] The module for X line image imaging devices according to claim 4 for dentistries to which said second cable is characterized by being thicker than said first cable.
[Claim 6] The module for X line image imaging devices according to claim 4 or 5 for dentistries characterized by arranging two of said photoelectrical elements on both sides of said solid-state image sensing device.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to X line image imaging device for dentistries with which a solid-state image sensing device can adjust the imaging time of X line image of the teeth automatically according to the irradiation time of X line source.
[0002]
[Description of the Prior Art] In X line image imaging device for dentistries, the fill MURESU method using solid-state image sensing devices, such as CCD, is proposed instead of the conventional silver halide film method. As compared with the conventional film method, this fill MURESU method The possibility of ** real-time observation, ** Since equipment and processing liquid for development have linear X line sensitivity characteristic of needlessness and ** solid-state image sensing device, there are ease [the possibility of reduction of the amount of X ray irradiation and Image Processing Division of X line image of which ** image

pick-up was done, the copy of X line image of which ** image pick-up was done, and preservation], and big Merritt of **.

[0003] In order to, synchronize the X ray radiation timing of an X ray radiation device, and picture reading operation of a solid-state image sensing device by a fill MURESU method on the other hand, The cable which connects the trigger pulse generating circuit and the drive control part of a solid-state image sensing device which detect the X ray radiation timing with which the X ray radiation device was equipped is needed. That is, through this cable, the trigger signal from a trigger pulse generating circuit is told to the drive control part of a solid-state image sensing device, and the picture reading signal is controlled by the drive control part. However, when there was this cable, there was a problem that the image pick-up work of X line image became troublesome.

[0004] In order to solve this problem, the technology formed in the CCD device side is known without establishing a trigger pulse generating circuit in an X ray radiation device. For example, with the equipment published by JP,H6-507796,A, the trigger pulse generating circuit is arranged across the back of CCD, i.e., CCD, at the opposite side of X line source. It enables a CCD device to adjust exposure time according to the time irradiated by the X-rays emitted from X line radiation device, without using the cable which connects an X ray radiation device and CCD according to this equipment.

[0005]

[Problem to be solved by the invention] In X line image imaging device for dentistries which picturizes X line image of the teeth, since the teeth image primary detecting element which accommodates CCD is used within the mouth, it becomes very important [miniaturizing a teeth image primary detecting element and aiming at improvement in the ease of using]. However, since the trigger pulse generating circuit is established in the back of CCD, the size of a teeth image primary detecting element becomes large, and makes displeasure borne against a patient when using it with the equipment published by above-mentioned JP,H6-507796,A as a result.

[0006] Moreover, the X-rays which penetrated CCD enter also into a trigger pulse generating circuit at the same time they enter into a photo-diode with a scintillator. With CCD, X-rays enter into a trigger pulse generating circuit also from a reverse side further. Thus, when X-rays enter into a trigger pulse generating circuit, the amount of signals and signal width of the signal itself which are generated from a trigger pulse generating circuit may be changed, or timing may be changed. Change of a signal or timing causes malfunction easily. Furthermore, since the characteristic of parts, such as IC which is the element which constitutes a trigger pulse generating circuit by incidence of X-rays, deteriorates, there is also a problem of degrading the characteristic of the circuit part itself.

[0007] This invention is made in order to solve such a conventional problem, and it aims at offering X line image imaging device for dentistries which can be stabilized and can generate a trigger pulse, and the module for X line image imaging devices for dentistries while it miniaturizes a teeth image primary detecting element.

[0008]

[Means for solving problem] In order to solve the above-mentioned technical problem, [X line image imaging device for dentistries of this invention] The scintillator which emits light by incidence of the penetration X-rays which penetrated the teeth which are a photographic subject, While picturizing the light emitted from the scintillator, for example, being arranged on the base board with which the solid-state image sensing device

and solid-state image sensing device like CCD are arranged, and a base board The teeth image primary detecting element which is made to produce photoelectric current, for example, has a photoelectrical element like a photo-diode when the light emitted from the scintillator enters, The imaging time control part which has the trigger pulse generating circuit which changes into a trigger pulse the photoelectric current outputted from the photoelectrical element, An image sensor control means to transmit the read-out signal for reading the integration time control signal which controls the imaging time of a solid-state image sensing device, and the electric signal accumulated in the solid-state image sensing device based on a trigger pulse to a solid-state image sensing device, While connecting a monitor means to display X line image of the teeth while connecting with an image sensor control means, and a teeth image primary detecting element and an imaging time control part, the electric signal accumulated in the solid-state image sensing device and the photoelectric current outputted from the photoelectrical element are transmitted to an imaging time control part from a teeth image primary detecting element. The first cable which transmits the read-out signal for reading the integration time control signal which controls the imaging time of a solid-state image sensing device, and the electric signal accumulated in the solid-state image sensing device from an imaging time control part to said teeth image primary detecting element, While connecting an imaging time control part and an image sensor control means, the electric signal outputted from the solid-state image sensing device and the trigger pulse outputted from the imaging time control part are transmitted to an image sensor control means from an imaging time control part. It is characterized by having the second cable which transmits the read-out signal for reading the electric signal accumulated in the solid-state image sensing device, and the integration time control signal which controls the imaging time of a solid-state image sensing device from an image sensor control means to an imaging time control part.

[0009] According to this X line image imaging device for dentistries, X line image of the teeth which are a photographic subject can be picturized by the solid-state image sensing device arranged at the base board through a scintillator. Moreover, the photoelectric current outputted by the trigger pulse generating circuit from a photoelectrical element corresponding to incidence of X-rays can be changed into a trigger pulse, and this trigger pulse is further changed into an integration time control signal in an image sensor control means. And the imaging time of a solid-state image sensing device is controlled by this integration time control signal.

[0010] The first cable which is especially connected to a teeth image primary detecting element according to this X line image imaging device for dentistries, Since the imaging time control part which forms the second cable connected to an image sensor control means, and is equipped with a trigger pulse generating circuit between these two cables has been arranged, While it becomes unnecessary to arrange a trigger pulse generating circuit to a teeth image primary detecting element and being able to attain the miniaturization of a teeth image primary detecting element, it can be stabilized and a trigger pulse can be generated.

[0011] The electric signal accumulated in the solid-state image sensing device is read by the signal transmitted from an image sensor control means, and X line image of the teeth is displayed by the monitor means.

[0012] Moreover, it is desirable for the second cable to be thicker than the first cable. If the first cable is thin, it will become easy to insert into a patient's mouth at the time of diagnosis. Moreover, even when the second cable was thick, a cable is stepped on on foot or rapid power is applied on the occasion of use, an internal line becomes is hard to be cut.

[0013] Furthermore, it is desirable to arrange two photoelectrical elements on both sides of a solid-state image sensing device. Even when one photoelectrical element has incidence of X-rays covered by preparing two photoelectrical elements by the teeth which are a photographic subject, the electric signal for controlling imaging time by the photoelectrical element of another side can be outputted.

[0014] [moreover, the module for X line image imaging devices of this invention for dentistries] While picturizing the scintillator which emits light by incidence of the penetration X-rays which penetrated the teeth which are a photographic subject, and the light emitted from the scintillator While being arranged on the solid-state image sensing device which outputs the electric signal accumulated by inputting a read-out signal from the exterior, the base board with which a solid-state image sensing device is arranged, and a base board The teeth image primary detecting element which has the photoelectrical element which produces photoelectric current when the light emitted from the scintillator enters, While connecting the imaging time control part which has the trigger pulse generating circuit which changes the photoelectric current outputted from the photoelectrical element into the trigger pulse which controls the imaging time of a solid-state image sensing device, and a teeth image primary detecting element and an imaging time control part Said electric signal accumulated in the solid-state image sensing device and the photoelectric current outputted from the photoelectrical element are transmitted to an imaging time control part from a teeth image primary detecting element. In order to control the imaging time of the read-out signal based on the trigger pulse inputted from the outside in order to read the electric signal accumulated in the solid-state image sensing device, and a solid-state image sensing device While connecting with the first cable which transmits the integration time control signal based on the trigger pulse inputted from the outside from an imaging time control part to a teeth image primary detecting element at an imaging time control part It is characterized by having the second cable which transmits outside the electric signal outputted from the solid-state image sensing device, and the trigger pulse outputted from the imaging time control part from an imaging time control part, and transmits the read-out signal inputted from the outside, and an integration time control signal to an imaging time control part.

[0015] If this module for X line image imaging devices for dentistries is used, X line image of the teeth which are a photographic subject can be picturized by the solid-state image sensing device arranged at the base board through a scintillator. Moreover, the photoelectric current outputted by the trigger pulse generating circuit from a photoelectrical element corresponding to incidence of X-rays is convertible for the trigger pulse used as the basis of the integration time control signal which controls the imaging time of a solid-state image sensing device.

[0016] Since the imaging time control part equipped with a trigger pulse generating circuit between the first cable and the second cable which are connected to a teeth image primary detecting element has been arranged especially according to this X line image imaging device module for dentistries, While it becomes unnecessary to arrange a trigger pulse generating circuit to a teeth image primary detecting element and being able to attain the miniaturization of a teeth image primary detecting element, it can be stabilized and a trigger pulse can be generated.

[0017] Moreover, it is desirable for the second cable to be thicker than the first cable. If the first cable is thin, it will become easy to insert into a patient's mouth at the time of diagnosis. Moreover, even when the second cable was thick, a cable is stepped on on foot or rapid power is applied on the occasion of use, an internal line becomes is hard to be cut.

[0018] Furthermore, it is desirable to arrange two photoelectrical elements on both sides of a solid-state image sensing device. Even when one photoelectrical element has incidence of X-rays covered by preparing two photoelectrical elements by the teeth which are a photographic subject, the electric signal for controlling imaging time by the photoelectrical element of another side can be outputted.
[0019]
[Mode for carrying out the invention] The suitable embodiment of X line image imaging device for dentistries concerning this invention and the module for X line image imaging devices for dentistries is explained in detail hereafter. First, reference is made about the composition of X line image imaging device for dentistries.
[0020] Drawing 1 is the figure which used X line image imaging device for dentistries for dental diagnosis. The X line source 1 which emits X-rays, and the sensor head 3 which is the teeth image primary detecting element prepared at the tip of the module 2 for imaging devices are set so that it may counter on both sides of a patient's teeth 1a. Moreover, the control box 5 which is the imaging time control part which controls the imaging time of X line image of Teeth 1a is connected to the teeth image primary detecting element 3 by the first cable 4. Furthermore, the control device 7 which is an image sensor control means is connected to the control box 5 by the second cable 6. And the monitor 8 which displays X line image of the teeth, and the printer 9 which outputs the contents of a display are connected to the control device 7.
[0021] Drawing 2 is the whole module 2 top view for imaging devices. The sensor head 3 carries CCD mentioned later in the inside of the resin case 3a. Moreover, the X ray acceptance surface 3b of the sensor head 3 has constituted the shape of an abbreviation rectangle with Earle to the corner. In addition, the X ray acceptance surface 3b is not restricted to the thing of the shape of an abbreviation rectangle shown in the figure, and can also be made into circular, an ellipse form, a square, etc. Moreover, the control box 5 has constituted rectangular parallelepiped form, and carries the trigger pulse generating circuit and buffer circuit which are mentioned later in the inside.
[0022] As for the first cable 4 which connects the sensor head 3 and a control box 5, the path is made smaller than the second cable 6. In this embodiment, although the path of the first cable 4 is about 3mm and the path of the second cable 6 is about 6mm, naturally it is not limited to this size. Moreover, although the length of the first cable 4 is about 20cm and the length of the second cable 6 is about 5m, it is not limited to this length and influenced by environment, such as a size of the sensor head 3, and width of a diagnostic room which performs dental diagnosis.
[0023] However, when the first cable 4 is long more than needed, in order for the cable itself to function as an antenna, it becomes easy to be influenced by the signal (noise) from the electromagnetism noise from peripheral equipment, such as an X-ray generator, and other cables. Furthermore, although the I-V converter constituted by OPEAMPU is contained like the after-mentioned in the trigger pulse generating circuit, if the first cable is too long, the problem that this OPEAMPU will oscillate will also be generated.
[0024] On the other hand, in the length of the first cable 4, distance with the short ** past ** case 3, i.e., a sensor head, and a control box 5 [a short ** past ** case] A control box 5 becomes obstructive at the time of use, or since the circuit part in a control box 5 becomes easy to receive radiation of direct X-rays, it becomes the cause of malfunction, or the circuit itself deteriorates easily.
[0025] Therefore, when the stability of the output of a trigger pulse generating circuit and reinforcement are taken into consideration, it is desirable to design to the length of the grade which the first cable 4 is not

influenced by a noise, and does not become obstructive at the time of use, or is not influenced by X-rays. In this case, in order to correspond to environment, such as width of a diagnostic room, it is necessary to adjust the length of the second cable 6. Therefore, the second cable 6 of a long time is more desirable than the first cable 4. In addition, the connector 10 for connecting the control device 7 and the module 2 for imaging devices is formed in the end of the second cable 6.

[0026] Next, the internal structure of the sensor head 3 is explained using drawing 3 and drawing 4 . Drawing 3 is the longitudinal section of sensor head 3 inside, and drawing 4 is the top view of sensor head 3 inside. The base board 12 of the product [center] made from copper tungsten almost on the laminated pedestal 11 for fixation made from Ceramics Sub-Division is formed, and CCD14 have pasted up with conductive resin on the base board 12. Wiring of CCD14 is pulled out from one of four sides, and forms the wiring part 15. And on both sides of CCD14, one band-like photo-diode 16 is installed at a time in two neighborhoods perpendicular to the neighborhood in which this wiring part 15 was formed. In addition, the base board 12 should just be the material which is not restricted to the thing made from copper tungsten, and can form a flat film with high precision.

[0027] The optical fiber plate 17 is being fixed to the upper part of CCD14 and each photo-diode 16 with adhesion resin so that these may be covered. And the scintillator 18 which consists of GOS (GADOMIUMUOKISHI sulfide) above this optical fiber plate 17 is arranged. In addition, a scintillator 18 is not restricted to GOS and NaI, CsI, etc. can also be used for it. The optical fiber plate 17 can be transmitted to the acceptance surface of CCD14, without diffusing the optical image changed by the scintillator. On the other hand, three steps of ceramic layers 13 are laminated by three sides on pedestals 11 for fixation other than the neighborhood in which the wiring part 15 of CCD14 was formed. Since only the highest rung layer has projected to the optical fiber plate 17 side among three steps of this ceramic layer 13, When laminating the ceramic layer 13, even if two lower layers cause a position gap, the optical fiber plate 17 is fixable with accuracy sufficient to CCD14 by adjusting the position of the projection part of a highest rung layer.

[0028] In addition, with the sensor head 3 in this embodiment, as mentioned above, although CCD14 and the band-like photo-diode 16 are formed with another object on the base board 12, CCD14 and the band-like photo-diode 16 can also be formed on the silicon substrate of CCD at a monolithic. Since it can approach more and these can be arranged when CCD14 and the band-like photo-diode 16 are formed in a monolithic, the further miniaturization can be realized and it becomes possible to manufacture the whole equipment at low cost further. Moreover, since CCD14 and a photo-diode 16 can be formed in the same process on a silicon substrate, a manufacturing process does not complicate them. Furthermore, CCD14 and a photo-diode 16 are arranged on the base board 12, respectively, and since it is not necessary to perform both position ******, simplification like an assembler can also be attained.

[0029] Then, with reference to drawing 1 and drawing 3 , the diagnostic process of the teeth using X line image imaging device for dentistries by this embodiment is explained. First, the sensor head 3 is applied to the back side of the teeth 1a which a patient should diagnose, the switch (not shown) of the X line source 1 is carried out to definite-period-of-time ON, and X-rays are emitted towards Teeth 1a. The penetration X-rays which penetrated Teeth 1a enter into the scintillator 18 of the sensor head 3. A scintillator 18 emits a photon, when penetration X-rays enter. By the emitted photon advancing the inside of the optical fiber plate 17, and reaching CCD14, CCD14 can picturize X line image of Teeth 1a. In addition, incidence of the photon emitted to CCD14 from the scintillator 18 will accumulate a signal electric charge into CCD14. Since the

amount of penetrations of X-rays increases about the cavernous portion when a cavity is in the part in Teeth 1a by causes, such as a cavity, the quantity of the photon emitted by a scintillator 18 as compared with a portion without a cavity increases, and the amount of signal electric charges accumulated in CCD14 also increases further.

[0030] Here, the control method of the imaging time of CCD14 is explained using drawing 5 - drawing 7 . In this embodiment, image pick-up operation (time) of one cycle of CCD14 consists of operation (time) which accumulates a signal electric charge, an integral action (time) called exposure operation, and read-out operation (time) which reads a signal electric charge.

[0031] Drawing 5 shows the flow from X ray irradiation to the monitor display of X line image. As shown in drawing 5 , the photon generated when X-rays and penetration X-rays irradiated a scintillator 18 enters not only into CCD14 but into two photo-diodes 16. If a photon enters into a photo-diode 16, photoelectric current will be produced, this photoelectric current will be transmitted in the first cable 4, and a photo-diode 16 will arrive at the trigger pulse generating circuit 19 in a control box 5. In addition, [when the number of photo-diodes 16 was one, even if X-rays were irradiated, when the diode became dental dirt and shadows, such as a gold tooth the malfunction of not generating photoelectric current arose, but] Malfunction can be prevented even when one photo-diode 16 becomes a shadow by forming two photo-diodes 16.

[0032] Drawing 6 shows the composition of the trigger pulse generating circuit 19, and drawing 7 is the timing chart of the trigger pulse generating circuit 19. In addition, (I) of drawing 7 - (VI) show (I) of drawing 6 - the signal in (VI). The trigger pulse generating circuit 19 is equipped with the I-V converter 19a, the amplification circuit 19b, Comparator 19c, the single stable multi-vibrator 19d, and Inverter 19e like drawing 6 .

[0033] The photoelectric current which arrived at the trigger pulse generating circuit 19 is changed into voltage with the I-V converter 19a like drawing 7 (II). It is the amplification circuit 19b, and this output voltage is amplified several times like drawing 7 (III), it is Comparator 19c and is changed into a digital signal like TTL from an analog signal like drawing 7 (IV). And after being extended by predetermined width like drawing 7 (V) by the single stable multi-vibrator 19d and being reversed like drawing 7 (VI) by Inverter 19e, a trigger pulse is outputted to the control device 7.

[0034] The integration of X line image of Teeth 1a begins in the falling portion of a trigger pulse, based on a trigger pulse, the control device 7 determines the integration time control signal which controls CCD14 so that integration may be completed in a standup portion, and it outputs this signal to CCD14. Moreover, the control device 7 determines the read-out signal which reads the signal electric charge of CCD14 based on a trigger pulse, and this signal is turned to CCD and it outputs it continuously.

[0035] [the circuit] although the trigger pulse generating circuit 19 which plays such a role conventionally was stored in the sensor head 3 Like this embodiment, a control box 5 can be established in the exterior of the sensor head 3, and the miniaturization of the sensor head 3 can be attained by storing the trigger pulse generating circuit 19 in this. Moreover, since the trigger pulse generating circuit 19 becomes that direct X-rays cannot glare easily, it can prevent the malfunction of the circuit by X ray incidence, and degradation of the circuit part itself.

[0036] Moreover, it becomes possible to use two cables which are called the first cable 4 and second cable 6 and with which thickness differs by having established the control box 5 in the exterior of the sensor head 3. Although not only the sensor head 3 but a part of first cable 4 enters in the mouth like drawing 8 when

diagnosing Teeth 1a, since the path of the first cable 4 is made thinly, in this embodiment, it can be smoothly inserted into the mouth. Moreover, it is desirable to form with the material in which the first cable 4 has pliability in view of being used within the mouth.

[0037] On the other hand, although the second cable 6 connected with the control device 7 is placed on a floor in many cases, even when it is involved in a leg since the path of the second cable 6 is made thickly, or it is trampled, in this embodiment, the wiring in a cable becomes that it is hard to be cut. Namely, [since there was no control box 5 which stores a trigger pulse generating circuit conventionally, had to make regularity the path of the cable which connects a sensor head and a control device, but] According to this embodiment, since the control box 5 was formed, it becomes possible the ease of carrying out of insertion into the mouth, and to cut wiring and to improve simultaneously in hard [both].

[0038] Then, process until it displays X line image picturized by CCD14 is explained. If the above-mentioned read-out signal for reading the signal electric charge accumulated in CCD14 from the control device 7 is sent, a read-out signal will progress the inside of the second cable 6, a control box 5, and also the first cable 4, and will reach CCD14.

[0039] If a read-out signal reaches CCD14, the signal electric charge accumulated in CCD14 will be read. A signal electric charge progresses the inside of the first cable 4 as an electric signal, and arrives at a control box 5. The signal electric charge generated in CCD14 is changed into a voltage signal by the load resistance prepared in MOSFET (not shown) of the output part of CCD14, and control box 5 inside.

[0040] Then, since the electric signal changed into the voltage signal can lower output impedance by the buffer circuit established in control box 5 inside, also when it becomes difficult to be influenced by a noise and a path is transmitted in the second thick cable 6, a signal ceases to deteriorate. The electric signal which passed through the buffer circuit progresses the inside of the second cable 6, and reaches the control device 7. In the control device 7, the electric signal can add computer-processing, and the X ray image pick-up result of Teeth 1a is displayed on a monitor 8.

[0041] Under the present circumstances, a cavity etc. can make a thin color the portion which has a cavity owing to, i.e., the portion which makes a deep color a portion with many signal electric charges accumulated in CCD14, and does not have a cavity, i.e., a portion with few signal electric charges, and can display it. Moreover, it is possible by changing the computer-processing method in the control device 7 to make a portion with many signal electric charges into a bright color, and to make a portion with few signal electric charges into a dark color etc. Moreover, the display result of a monitor 8 is outputted by a printer 9.

[0042]

[Effect of the Invention] The first cable which is connected to a teeth image primary detecting element according to the X line image imaging device for dentistries by this invention, Since the imaging time control part which forms the second cable connected to an image sensor control means, and is equipped with a trigger pulse generating circuit between these two cables has been arranged, While it becomes unnecessary to arrange a trigger pulse generating circuit to a teeth image primary detecting element and being able to attain the miniaturization of a teeth image primary detecting element, it can be stabilized and a trigger pulse can be generated.

[0043] Moreover, it can be made easy to insert into a patient's mouth by making the first cable thinner than the second cable at the time of diagnosis. Moreover, even when making the second cable thick, and a cable is stepped on on foot or rapid power is applied on the occasion of use, an internal line can make it be hard to

be cut.

[0044] Furthermore, even when one photoelectrical element has incidence of X-rays covered by dental dirt, a dental gold tooth, etc. by preparing two photoelectrical elements, the electric signal for controlling imaging time by the photoelectrical element of another side can be outputted.

[Brief Description of the Drawings]

[Drawing 1] It is the figure showing one work example of X line image imaging device for dentistries by this invention.

[Drawing 2] It is the whole top view showing one work example of the module for X line image imaging devices for dentistries by this invention.

[Drawing 3] It is a longitudinal section inside the sensor head of X line image imaging device for dentistries.

[Drawing 4] It is a top view inside the sensor head of X line image imaging device for dentistries.

[Drawing 5] It is a flow chart from X ray irradiation to the monitor display of X line image.

[Drawing 6] It is the composition figure of a trigger pulse generating circuit.

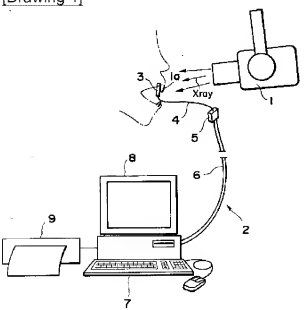
[Drawing 7] It is the timing chart of a trigger pulse generating circuit.

[Drawing 8] It is the enlarged drawing showing the busy condition of X line image imaging device for dentistries.

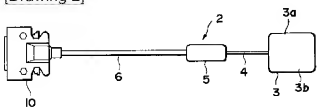
[Explanations of letters or numerals]

1 -- X line source, 2 -- The module for imaging devices, 3 -- Sensor head (teeth image primary detecting element), 4 [-- A control device (image sensor control means), 14 / -- CCD, 16 / -- A photo-diode, 17 / -- An optical fiber plate, 18 / -- A scintillator, 19 / -- Trigger pulse generating circuit.] -- The first cable, 5 -- A control box (imaging time control part), 6 -- The second cable, 7

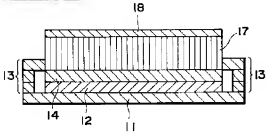
[Drawing 1]



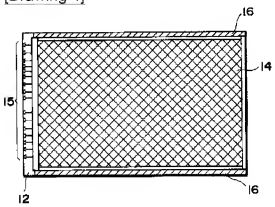
[Drawing 2]



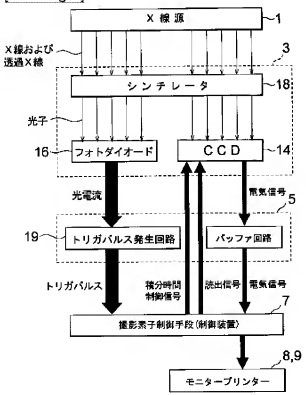
[Drawing 3]



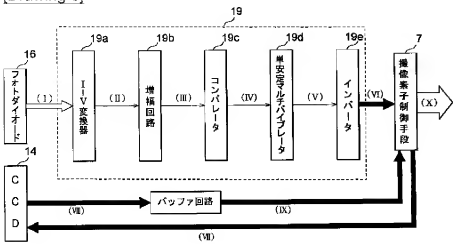
[Drawing 4]



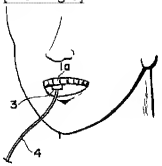
[Drawing 5]



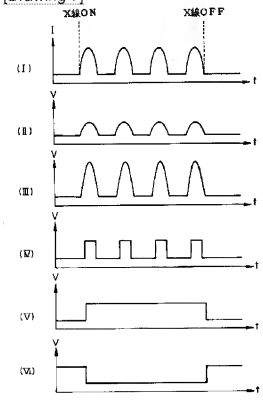
[Drawing 6]



[Drawing 8]



[Drawing 7]



トリガパルス発生回路のタイミングチャート

[Translation done.]